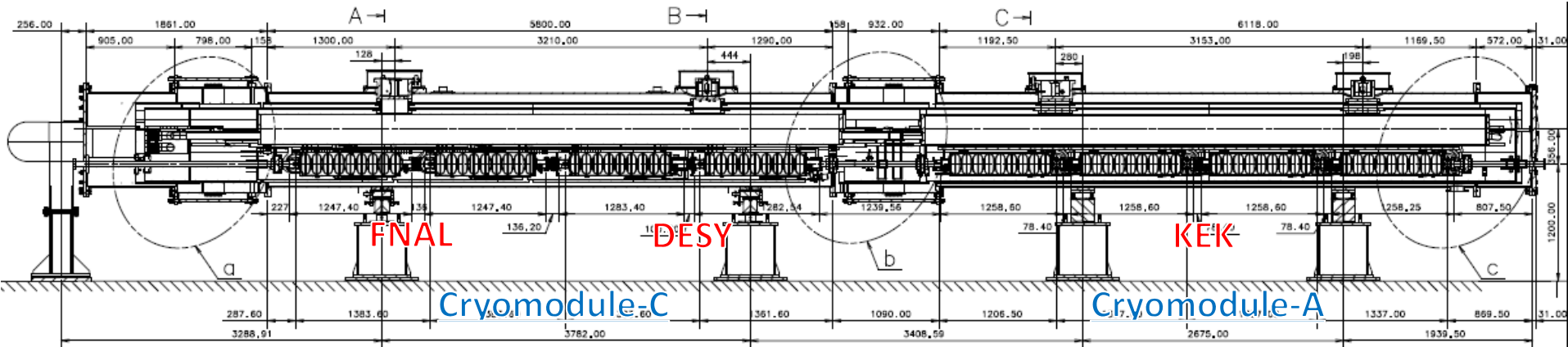
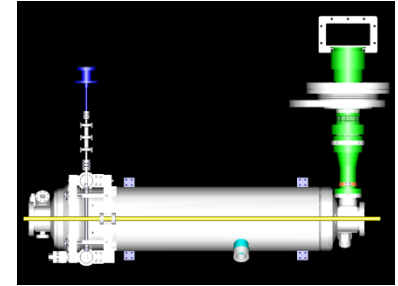
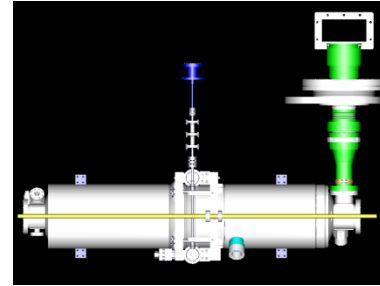
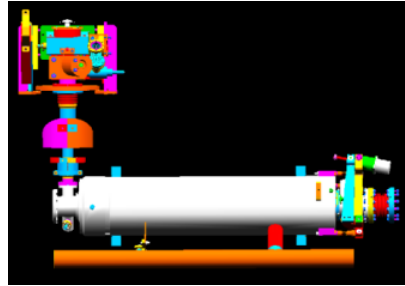
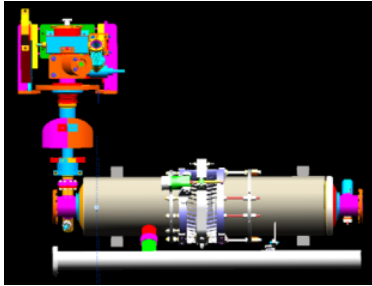


Schedule and design of the S1-G cryomodules

Norihito Ohuchi

ILC cryomodule/cryogenics Groups

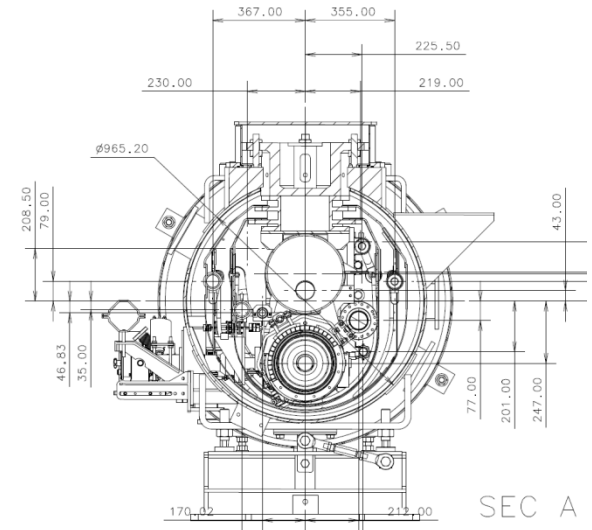
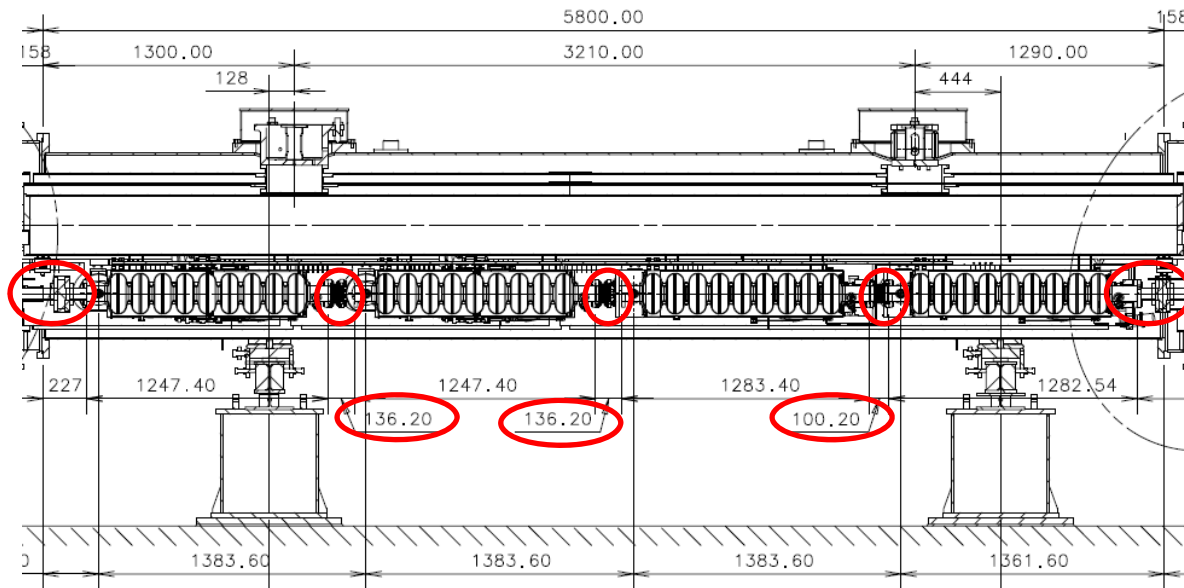
General design of S1-G cryomodules



1. Design of the Module-C and -A for S1-G started at May 2008.
2. Module-C has two FNAL cavities and two DESY cavities, and Module-A has four KEK cavities.
3. Two vacuum vessels are connected with a vacuum bellows.
4. The total length of the S1-G modules including end cans is designed to be 14900 mm.

Cryomodule-C design (1)

Module-C



Cross section of Module-C

Design features of Module-C:

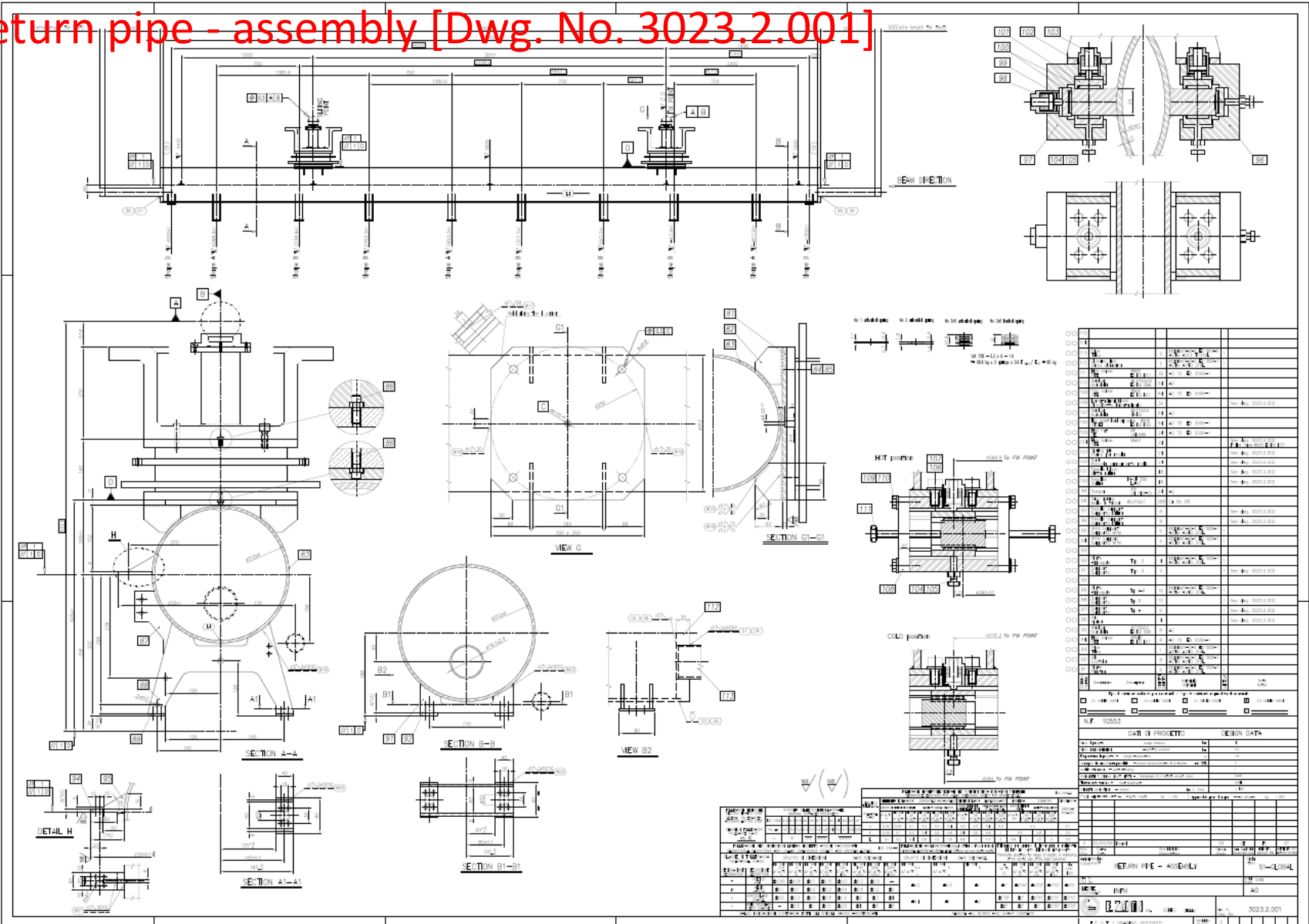
- Design difference of cavity packages are included;
 - DESY cavity: Saclay tuner, outer magnetic shield and package length=1283.4mm
 - FNAL cavity: Blade tuner, outer magnetic shield and package length=1247.6mm
 - Supporting conditions under the GRP are same between two types of cavities.
- Distance lengths between input couplers are constant at 1383.60 mm.
- The components, like connection bellows between cavities and gate valves, will be designed from now.
 - Bellow length between FNAL cavities=138.2mm, between DESY cavities=100.2mm

Cryomodule-C design (2)

1. CAD-work and construction process of the Module-C by Zanon are controlled by INFN.
2. Main parameters of the Module-C were confirmed at January 2009, and Zanon started to produce the manufacturing drawings.
 - The whole set of drawings has been completed, and they are reviewed with INFN .
 - Review of drawings by KEK has been completed last week.
 - Assembly drawings:
 - Typical cross section on cavity [Dwg. No. 3023.0.003]
 - 70K shield [Dwg. No. 3023.4.001]
 - 4.5K shield [Dwg. No. 3023.3.001]
 - 4.5K & stepping motor pipe [Dwg. No. 3023.5.002]
 - Return pipe - assembly [Dwg. No. 3023.2.001]
 - Cold mass & vacuum vessel [Dwg. No. 3023.0.002]
 - Adjustable support assembly [Dwg. No. 3023.1.004]
 - Vacuum vessel shell – assembly [Dwg. No. 3023.1.001]
 - Vacuum vessel shell – details [Dwg. No. 3023.1.002]
 - Warm_up tube [Dwg. No. 3023.5.003]
 - 70K pipe [Dwg. No. 3023.5.001]

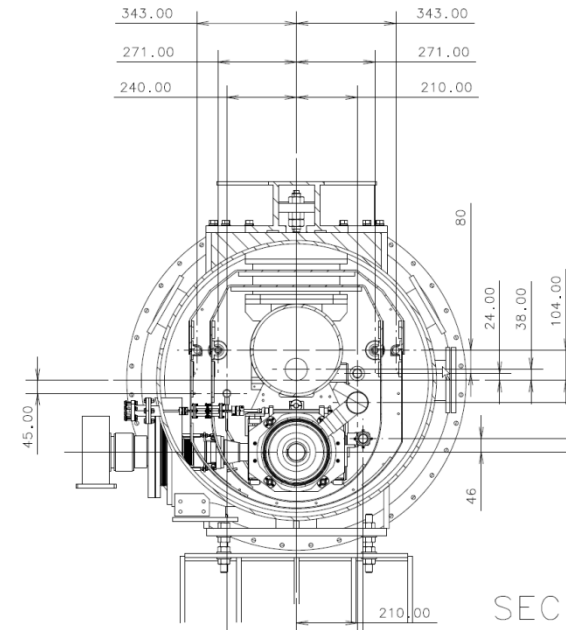
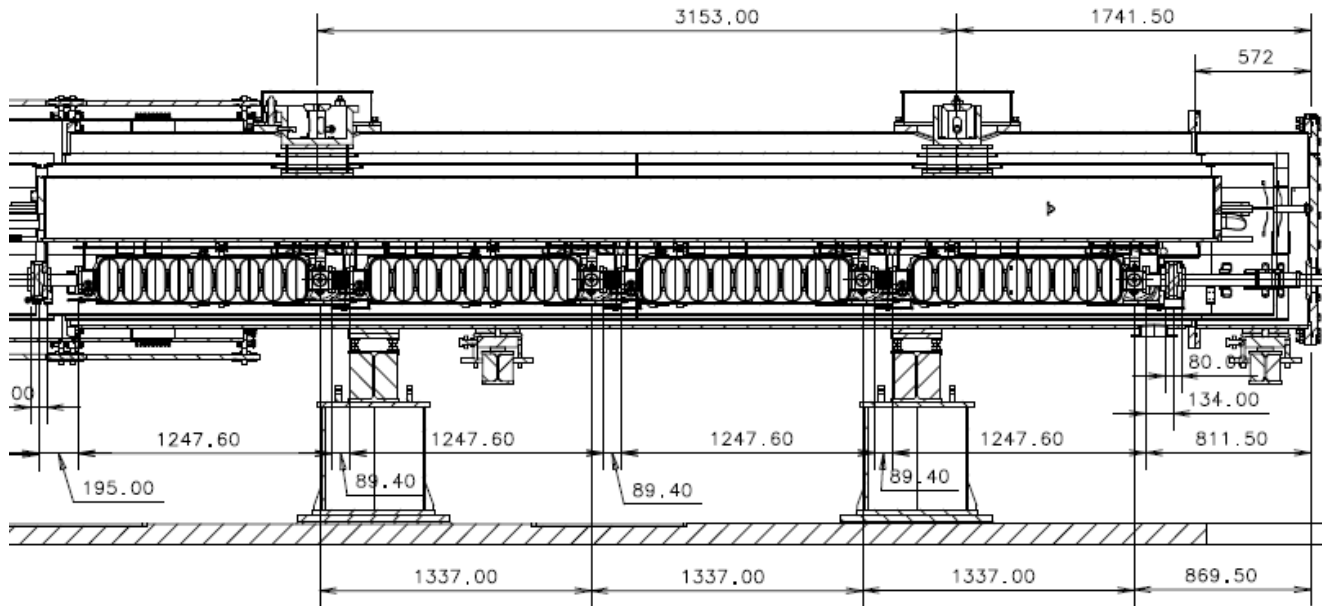
Drawings for the module-c components

Return pipe - assembly [Dwg. No. 3023.2.001]



Cryomodule-A design (1)

Module-A

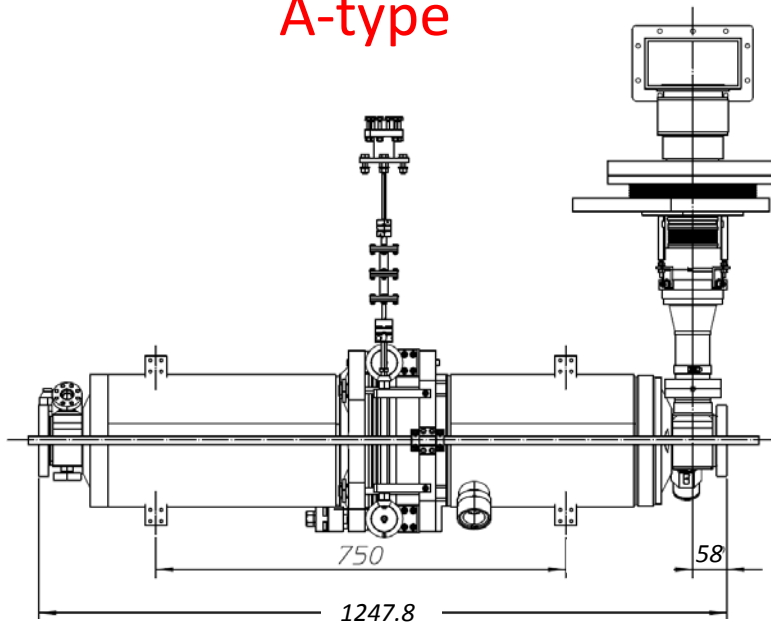


Cross section of Module-A

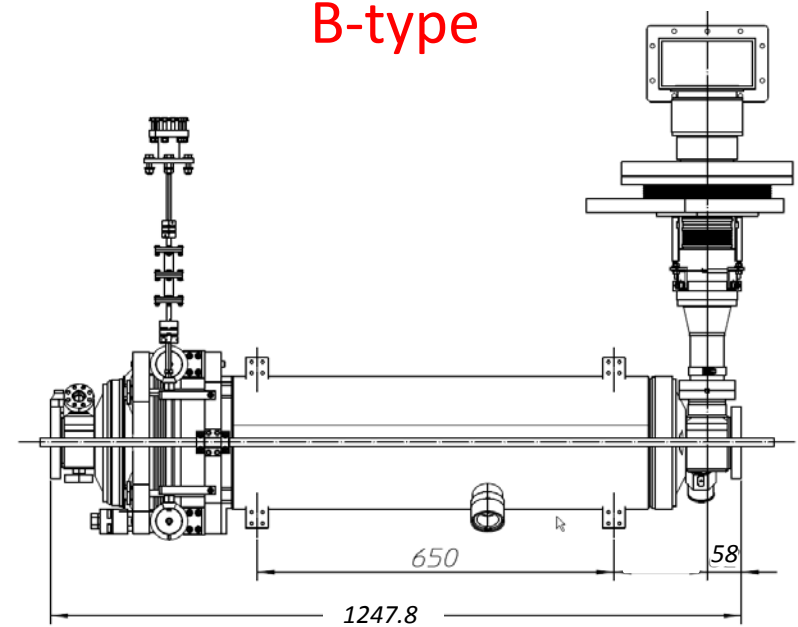
1. KEK has responsibilities on the design and CAD work of Module-A, and the data are reviewed in the S1-G cryomodule/cryogenics group.
2. Design features of Module-A:
 - Cooling pipe sizes are different from those of Module-C.
 - Module-A is connected to Module-C with a big vacuum bellows and reduced cooling pipes.
 - **KEK cavity: slide jack tuner, inner magnetic shield and package length=1247.8mm.**
Bellow length between KEK cavities=89.4mm

KEK cavities of S1-G cryomodule

A-type



B-type



- The tuner is located in the middle of He jacket.
- The support lug distance is 750 mm.
- The plug compatible standard design
- The tuner is located out side of support lugs and on the opposite side of input coupler.
- The support lug distance is 650 mm.

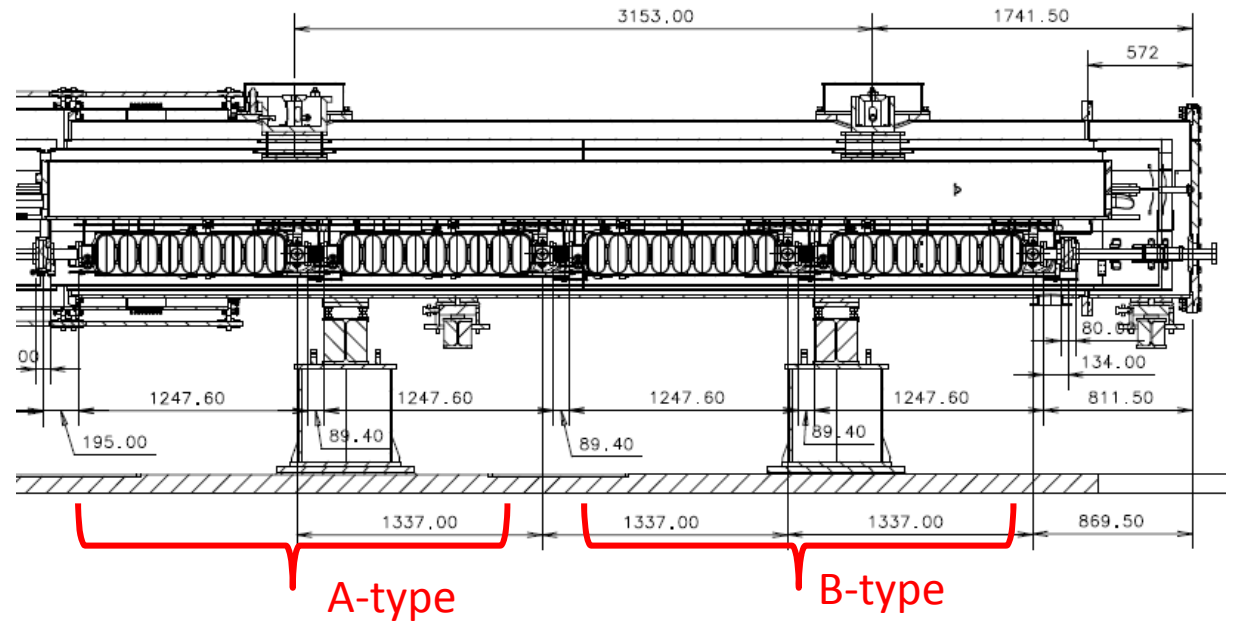
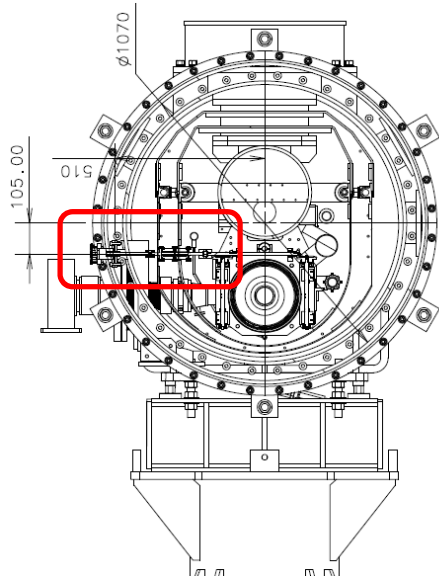
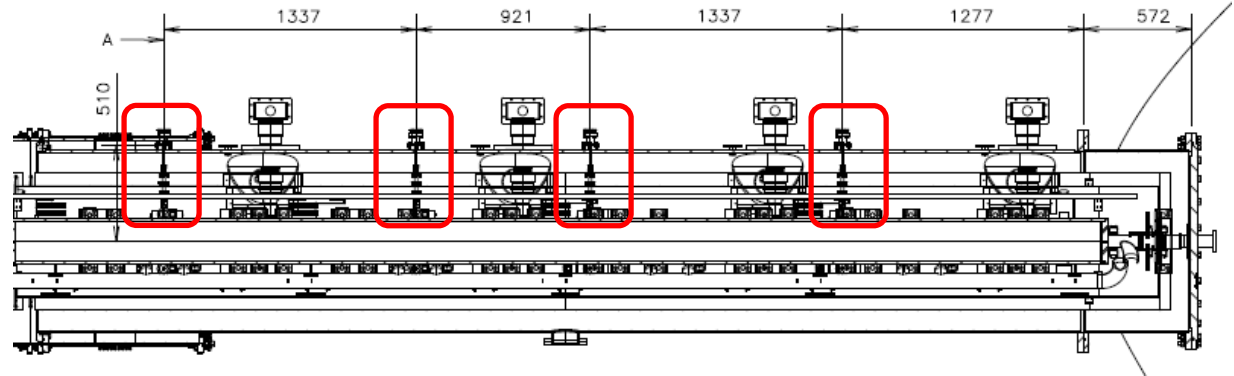
KEK is constructing five Tesla-like cavities for S1-G.

- A-type: 3 cavities, B-type: 2 cavities, and choosing the better four cavities in the five cavities.
- The distance between cavity flanges is designed to be 1247.8 mm while 1258.6 mm for the old design.

Assembly design of Module-A

The vacuum vessel should be modified in order to make ports for tuner driver shafts at the different positions.

Tuner driving shaft



Design works in detail

- Design of interface components
 - Interface areas between Module-A and Module-C, Module-C and valve box
 - Beam pipe
 - Gas return pipe
 - Liquid helium supply pipe
 - Cooling pipes for thermal shields, Cool-down and warm-up pipe
 - Additional thermal shields
 - WPM system
- Module-A modification
 - Vacuum vessel
 - Tuner ports
 - Gas return pipe
 - Support mechanism for accommodating two types of cavity vessels
 - New gas return pipe will be constructed.
 - Liquid helium supply pipe of Ti (not including Ti-SUS junctions)
- Additional vacuum short pipes at both sides of Module-C vessel

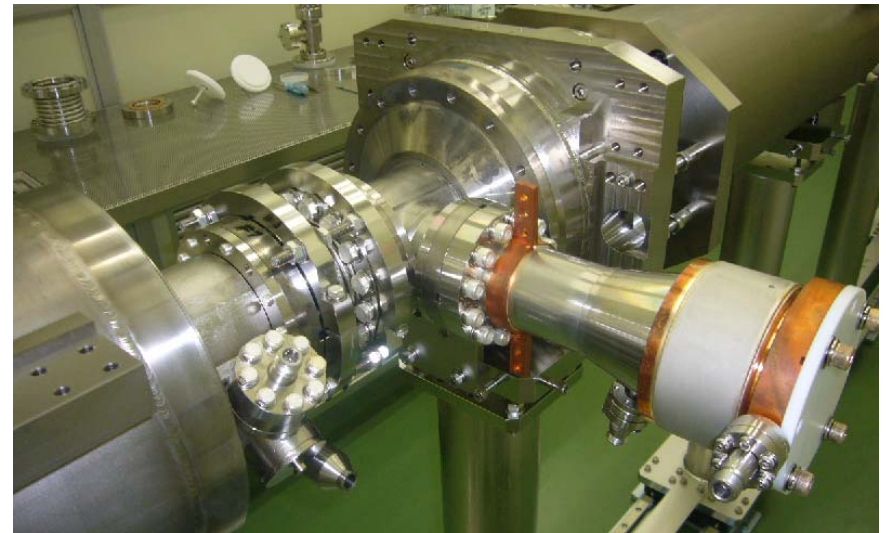
Assembly study from NOW

Assembly works in the clean room

- Making a string of cavity packages and assembly of input couplers to beam pipe.
- Alignment procedure of cavities in a string, and alignment tools.
- Difference of the cavity package shape
 - DESY and FNAL cavity packages have helium supply pipe, Saclay/Blade tuners. DESY input coupler
 - KEK cavity packages have no helium supply pipe, Slide jack tuner and KEK input coupler.



DESY cavity and input coupler

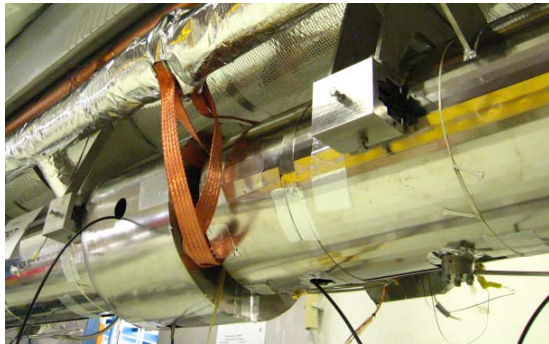


KEK cavity and input coupler

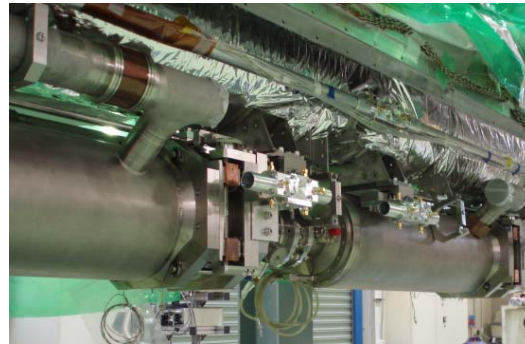
Assembly works out of the clean room

- Assembling different type of tuners and cavity packages including magnetic shields
- Aligning cavity-package with respect to the fiducials on the cryomodule
- Supporting a cavity package string to the Gas Return Pipe
- Assembling the thermal radiation shields, thermal intercepts and SI on the shields
- Test schemes against high pressure and the vacuum leak of the cooling pipes
- Inserting the cold mass into the vacuum vessel

Assembly procedures of DESY/FNAL/KEK cavities should be confirmed and tools should be prepared before module assemblies.



Outer magnetic shields for DESY/FNAL cavities



Magnetic shields inside KEK cavity jackets



DESY



KEK

Schedule for S1-G cryomodules

	2009				2010			
	1,2,3	4,5,6	7,8,9	10,11,12	1,2,3	4,5,6	7,8,9	10,11,12
Module-C design	→							
INFN Module-C construction		→		↓				
Module-C arriving at KEK				→				
DESYS and FNAL cavities at KEK				→				
Design of assembly tools inside/outside clean room		→						
Modification and construction of assembly tools			→					
Preparation of cavities for clean room				◆				
Clean room work FNAL/DESYS cavities				◆				
Module C assembly work out of the clean room					↔			
Module-A modification and interface design		↔						
Interface components and vessel modification			↔					
Construction and tests of KEK cavities for S1	→							
Jacketing KEK cavities				↔				
Clean room work					◆			
Cryomodule A assembly with new KEK cavities					↔			
Installation of Modules A and C in the tunnel						↔		
Operation of S1-Global cryomodules							←	→

Assuming that FNAL cavities will be transported to STF after vertical tests.

